At the time of the signing of the armistice about 300 men, trained at Weather Bureau stations and at the school of meteorology in Texas, had been sent overseas; and about 200 men were assigned to a score or more of the flying fields, artillery and ordnance camps, balloon schools, and radio detachments in this country, for the purpose of supplying these branches of the Army with the meteorological data desired. A score or more of the graduates of the school who are stationed at headquarters in Washington engaged in the reduction of field observations, in the charting of upper air currents, and in necessary administrative duties. Twenty-five of the members of the class were transferred to the Navy for duty in connection with the development of the hydrophone, an instrument designed to detect the presence of submarines.

The School of Meterology was not a unit of the Students' Army Training Corps. It was organized and maintained under the direct supervision of the Chief Signal Officer of the Army.

NEW METEOROLOGICAL BOOKS.

Physics of the Air.

The most thorough American work on general meteorology which has appeared for many years is Prof. W. J. Humphreys's, Physics of the Air. Part I, on Mechanics and Thermodynamics of the Atmosphere (also, atmospheric electricity), was published [1] in 14 installments, making 402 pages, in the Journal of the Franklin Institute, 1917 and 1918. Some 300 copies of Part I will be made up in book form. The purpose of the work is to present a comprehensive, explanatory statement of the physics of the air; one which may form the basis for new courses in meteorology in college and university departments of physics. Much of the argument is developed by the author; in fact, almost without exception the formulas used are derived in the text. Where further information might be of value, Prof. Humphreys not only has given detailed references to the comprehensive literature on meteorological physics contained in the Weather Bureau library, but he has also incorporated digests of these articles and works in his discussion. Thus the reader does not need to look up the references unless he wishes to make a special study in any line.

The scope of the book is all that is implied in the title, the physics of the air. In the first chapter, the sources of meteorological information and the interrelations of the meteorological elements are discussed and illustrated. Then follows, chapters 2 to 6, a careful mathematical exposition concerning the temperature, composition, and heating of the atmosphere. Particular attention is paid to adiabatic changes, to the vertical distribution of temperature,[2] and to the cause of the isothermal condition of the stratosphere.[3]

The middle third of the book, chapters 7 to 10, comprises a thorough exposition of the winds, which are classified according to their immediate causes: (1) local heating; (2) cooling; (3) local heating and cooling; (4) widespread heating and cooling, and (5) external force. Group 1 includes sea breezes and valley winds. Group 2 comprises land winds, mountain winds, and all sorts of fall-winds. Group 3 is of thunderstorm winds. Group 4 involves cyclones and anticyclones, continental winds, and the planetary circulation of the atmosphere; and group 5 includes forced winds, tornadoes, and the foehn. Although each teacher of meteorology will prefer to make some changes in this classification, probably by combining groups 1 and 2, at least, this new classification of winds on the basis of immediate causes has been found better for instruction than a classification based on the original source of energy.[4]

Chapter 11, on barometric fluctuations, contains an explanation of barometric "ripples" and a rather full description and explanation of the diurnal and semidiurnal pressure changes.[5] In chapter 12 the author presents in some detail the rather intricate subject of evaporation and condensation. Fogs and clouds, in chapter 13, are discussed too briefly to do justice to these visible signs of atmospheric processes; the explanatory descriptions and the carefully selected cloud pictures are well worth double the space accorded them. The thunderstorm, in chapter 14, receives the space appropriate to such a commanding phenomenon. It is considered as a whole, and each of its elements, especially lightning,[6] are treated in detail. In the following chapter, the scattered results of investigations in atmospheric electricity are bound together. A detailed outline of the history of the development of our knowledge of the subject is given in the first two pages. Then follow in succession brief, though explicit, treatments of the electrical field of the earth, the electrical conductivity of the atmosphere, ionic content of the air, electrical currents in the atmosphere, radioactive content of the atmosphere, penetrating radiation, and origin and maintenance of the earth's charge. A brief discussion of the aurora closes Part I.[7]

Since the present edition is so limited the work is not yet readily available. Nevertheless, Prof. Humphreys has made it no longer necessary to go to works in a foreign language for books on advanced meteorological physics. A review in Nature (London, May 23, 1918, p. 231) says:

> For the large number of readers interested in the fundamental facts of meteorology, there has, up to the present, been no trustworthy text-book which discussed the subject from so scientific a viewpoint or dealt with its modern developments so completely.—C. F. B.

Manual of Meteorology.

Part IV of a voluminous manual of meteorology by Sir Napier Shaw has just appeared (Cambridge, England, 1919).[8] In the preface the author mentions the contents of the different parts to be as follows: I, A general survey of the globe and its atmosphere; II, The physical properties of the air; III, The dynamical and thermal principles upon which theoretical meteorology depends; IV, The relation of the wind to the distribution of barometric pressure. A more extended notice of this work will be published in a later issue of the REVIEW.—C. F. B.

Introductory Meteorology.

As a text or reference book for the Students' Army Training Corps, Introductory Meteorology was written by officials of the Weather Bureau at the request of Prof. H. E. Gregory, representing the National Research Council. The manuscript was prepared in a fortnight in August, and the book appeared from the Yale University Press in October, 1918. (8vo., 149 pp., 71 figs., $1 gross.) Chapters I, the Atmosphere; part of IV, Atmospheric Pressure; V, Evaporation and Condensation; and VI, Fogs and Clouds, are taken largely verbatim from Prof. Humphreys's, Physics of the Air; and Chapters VII, Atmospheric Optics, and VIII, General Circulation of

[1] Published by the Franklin Institute in cooperation with the Weather Bureau.
[2] Cf. pp. 564–565 of this issue of the MONTHLY WEATHER REVIEW.
[3] Cf. p. 564 of this issue of the MONTHLY WEATHER REVIEW.
[4] Cf. W. M. Davis, Elementary meteorology, Boston, 1894, p. 112.
[5] Cf. p. 565 of this issue of the MONTHLY WEATHER REVIEW.
[6] Ibid., pp. 565–566.
[7] Cf. the outline and discussion of the arrangement of the work as a whole, ibid., p. 558.
[8] Pts. 1–3, not yet issued, pl. 4, 4°, 160 pp.

the Atmosphere, were prepared specially by Prof. Humphreys for this book. Chapter II, Measurement of Meteorological Elements, by S. P. Fergusson, is a brief discussion of instruments and methods of observaton. Chapter III, Atmospheric Temperature, by W. R. Gregg, is a well-illustrated discussion of the subject; which, however, would be easier to grasp if part 2 preceded part 1. The section on vertical distribution of temperature is based largely on the most recent data collected in the United States.[9] Prof. J. Warıen Smith prepared the brief chapter, IX, on Secondary Circulation of the Atmosphere. Prof. A. J. Henry's chapter, X, on Forecasting the Weather, is a brief statement of the interesting subject. Chapter XI, Climate, by Prof. C. F. Talman, is likewise by necessity highly condensed. The bibliography contains classified references to the more important works on meteorological topics; though in the references on clouds, Clayton's extensive "Discussion of the Cloud Observations," made at Blue Hill Observatory,[10] and the Weather Bureau's voluminous "Report on the International Cloud Observations" have been omitted.[11]

A book of this nature, put together so rapidly, is bound to show lack of unity and unevenness of treatment. Some teachers have described *Introductory Meteorology* as uninteresting and too difficult for the elementary student. The first point, that it is uninteresting, is founded on the fact that it is practically nothing but meteorology, there being little or no mention of the human applications or effects of the elements discussed; and the second objection, that it is too difficult, is based on the necessarily condensed treatment of some of the more difficult parts. The book was not intended to be complete in itself. The authors, however, may have overestimated the meteorological knowledge of many instructors and the time available to others for preparing supplemental lectures. These objectionable features may be easily remedied if there is a call for a somewhat enlarged edition.

On the whole, the book is filling a demand for a brief book on modern meteorology.[12]—C. F. B.

A Manual of Aerography.

"A Manual of Aerography," issued by the United States Navy, was compiled by Lieut. Commander Alexander McAdie.[13] The book is composed of individual chapters assembled essentially without reference to one another, several of which are taken directly from the compiler's "Principles of Aerography" (Chicago, 1917). There are chapters on fundamental units, formulæ, and tables; but most of the book is made up of brief discussions of the major branches of meteorology. Two of the chapters deal with the effects of meteorological conditions on flying: one, by Prof. W. J. Humphreys, is published here only; while the other, by Capt. C. J. P. Cave, is reprinted from the Aeronautical Journal, London, 1917.—C. F. B.

A Treatise on the Sun's Radiation and other Solar Phenomena.

[In continuation of A Meteorological Treatise on the Circulation and Radiation in the Atmosphere of the Earth and of the Sun, 1915.]

Much of this work deals with the solar constant, radiation, and the application of solar data to short and long range forecasting; therefore, it is of interest to meteorologists, although they can not agree with many of the author's conclusions.[14]

Reviews of the earlier work on atmospheric circulation and radiation [15] have been published by F. W. Very, in Science, December 3, 1915 (N. S., vol. 42, pp. 800–805), by A. McAdie, in Geographical Review, October, 1916 (vol. 2, pp. 323–324), and by H. Bateman in Astro-physical Journal, December, 1916 (vol. 44, pp. 342–344).—C. F. B.

Meteorological Glossary.

[Fourth Issue, London, 1918.]

This valuable publication of the British Meteorological Office constitutes a companion volume to the interesting little primer of practical meteorology known as "The Weather Map." While it contains numerous meteorological definitions, it is not primarily a lexicographic work, but rather a compend of information on various meteorological topics, arranged in alphabetical order. A more extended notice of this publication will appear in a later number of the REVIEW.—C. F. T.

SOME RECENT CONTRIBUTIONS TO THE PHYSICS OF THE AIR.[1]

By W. J. HUMPHREYS, Professor of Meteorological Physics, U. S. Weather Bureau.

There has come to us from ancient times the story of a foolish man who sold his birthright for a mess of pottage, and that story to-day is right applicable to us physicists, except in one important particular—we haven't even got the pottage. No department of learning has a richer birthright than has the department of physics in meteorology—the physics of the air. And yet the few institutions that even profess to teach this subject in any form offer it through the department of geology, or more frequently still, that omniverous department which, for want of a better name, is called the department of geography. Statistical meteorology, if such expression will be permitted, or climatology, is of course of great interest alike to the geologist and the geographer, and this they should teach and in a great measure do teach; but climatology is no more meteorology than descriptive geography, for instance, is geology. Its value is great and unquestioned, but its function, like the function of geography, is merely to describe and not to explain.

Meteorology, on the other hand, is concerned with causes; it is the physics of the air—a vast subject of rapidly-growing importance upon which peace and war alike are becoming more and more dependent. Only yesterday we

> "Heard the heavens fill with shouting,
> And there rained a ghastly dew
> From the nation's airy navies
> Grappling in the central blue;"

and to-day

> "Saw the heavens fill with commerce,
> Argosies of magic sails,
> Pilots of the purple twilight,
> Dropping down with costly bales."

It is therefore no longer an opportunity, a shamefully neglected opportunity, that invites, but an imperative duty that commands our leading institutions to add to the various subjects taught, studied, and investigated in

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[9] See "Mean values of free-air barometric and vapor pressures, temperatures, and densities over the United States," by W. R. Gregg, MONTHLY WEATHER REVIEW, 1918, 46: 11–21.

[10] Ann. Ast. Obs. Harv. Coll., 1896, vol. 30, pt. 4, 4°, 500 pp., 17 pl.

[11] By F. H. Bigelow, Report of the Chief of the Weather Bureau, 1898–99, vol. 2, 1900, 4°, 787 pp.

[12] For other reviews of this book, see one by "M." in Science, Dec. 6, 1918, pp. 576–577, and another by R. De C. Ward, in Geogr. Rev., 1919. vol. 7.

[13] Government Printing Office, 1918, 165 pp. 8vo.

[14] Cf. C. G. Abbot, Pyrheliometry and solar radiation, Science, June 21, 1918, pp. 609–610 and F. H Bigelow's reply, Science, Oct. 25, 1918, pp. 417–418.

[15] A Meteorological treatise on the circulation and radiation in the atmospheres of the earth and of the sun. New York, 1915, 431 pp., 78 figs.

[1] Extracts from vice-presidential address, Physics section, A. A. A. S., Baltimore, December, 1918. Published in full, Science, Feb. 14 and 21, 1919, N. S., vol. 49, pp. 155–163, 182–186, 6 figs.